Center Independent Research & Development: GSFC IRAD

CubeSat Attitude Control System Testbed

Completed Technology Project (2015 - 2021)

Project Introduction

Design, build, and test a CubeSat attitude control system (ACS) testbed that will allow Goddard Space Flight Center (GSFC) CubeSats to test their ACS functionality.

The primary objective is to design, build, and test a CubeSat ACS testbed in order to provide technology to buy down risk for GSFC CubeSat missions. The testbed will look to provide the following capabilities:

- Accommodation for CubeSats ranging in size from 1U to 6U

- Three axis movement to allow for phasing demonstration

- Light source movement to demonstrate system response to sun sensor inputs

- Dipole measurement to quantify torque capability

- Torque measurement to quantify reaction wheel capability

- Real time data and video capture

The goal of this system will be to test functionality of the ACS and not to develop a detailed performance profile. The main attractiveness is for the engineer to be able to test phasing of different satellite modes. Demonstrating that the satellite responds as expected to both software commands and external inputs is valuable to increasing confidence in the design.

Anticipated Benefits

The testbed will provide an option for NASA funded CubeSat missions to perform more comprehensive tests on their ACS system and reduce the level of risk currently being taken by performing limited tests and relying heavily on mathematical predictions. The reduction in risk would further increase the probability of success for these missions.

The testbed will provide an option for NASA unfunded and planned CubeSat missions to consider performing more comprehensive tests on their ACS system and reduce the level of risk currently being taken by performing limited tests and relying heavily on mathematical predictions. The reduction in risk would further increase the probability of success for these missions.

Commercial CubeSat missions could also utilize the testbed for their ACS system testing needs and help increase their probability of success.

Other government agencies would also be able to utilize the testbed for their CubeSat missions and help increase their probably of success.

CubeSat with COTS ACS System

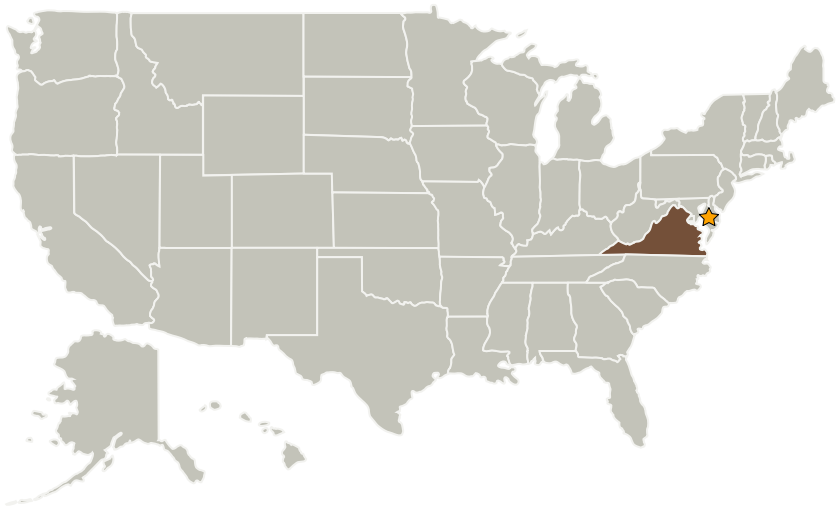
Table of Contents

Center Independent Research & Development: GSFC IRAD

CubeSat Attitude Control System Testbed

Completed Technology Project (2015 - 2021)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Wallops Flight Facility(WFF)	Lead Organization	NASA Facility	Wallops Island, Virginia

Primary U.S. Work Locations
Virginia

Project Transitions

October 2015: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Wallops Flight Facility (WFF)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Managers:

Michael J Viens
Daniel A Mullinix

Principal Investigator:

Zachary W Peterson

Co-Investigator:

John D Hudeck

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September 2021: Closed out

Closeout Summary: Accomplishments include performing an error analysis on the torque table which measured reaction wheel torques. It was discovered that this may be a challenge and that more work will be required to develop alternati ve techniques. Additionally, proof of concept work was performed for a star simu lator that will add to lab capabilities. The purpose of the Goddard Space Flight C enter's Internal Research and Development (IRAD) program is to support new te chnology development and to address scientific challenges. Each year, Principal Investigators (PIs) submit IRAD proposals and compete for funding for their dev elopment projects. Goddard's IRAD program supports eight Lines of Business: A strophysics; Communications and Navigation; Cross-Cutting Technology and Ca pabilities; Earth Science; Heliophysics; Planetary Science; Science Small Satellit es Technology; and Suborbital Platforms and Range Services. Task progress is e valuated twice a year at the Mid-term IRAD review and the end of the year. Whe n the funding period has ended, the PIs compete again for IRAD funding or seek new sources of development and research funding, or agree to external partners hips and collaborations. In some cases, when the development work has reache d the appropriate Technology Readiness Level (TRL) level, the product is integra ted into an actual NASA mission or used to support other government agencies. The technology may also be licensed out to the industry. The completion of a pr oject does not necessarily indicate that the development work has stopped. The work could potentially continue in the future as a follow-on IRAD; or be used in collaboration or partnership with Academia, Industry, and other Government Ag encies. If you are interested in partnering with NASA, see the TechPort Partners hips documentation available on the TechPort Help tab. http://techport.nasa.go v/help

Images

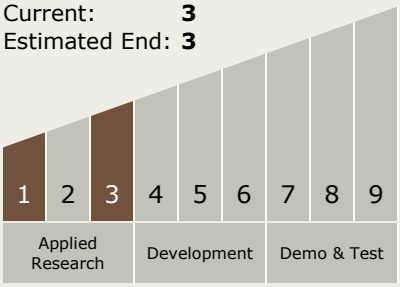
NASA 3U CubeSat
CubeSat with COTS ACS System
(https://techport.nasa.gov/imag e/40393)

Links

NASA Goddard Website
(http://www.nasa.gov/centers/goddard/home/index.html)

Technology Maturity (TRL)

Start: **1**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX17 Guidance, Navigation, and Control (GN&C)
  - TX17.5 GN&C Systems Engineering Technologies
    - TX17.5.4 GN&C Ground Testbeds/Test Facilities

Target Destination

Foundational Knowledge

Supported Mission Type

Push

NASA Wallops Facebook
(https://www.facebook.com/NASAWFF)

NASA Wallops Twitter
(https://twitter.com/nasa_wallops)

Project Website:

http://aetd.gsfc.nasa.gov/